Reliability Databases

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International Nuclear Safety and Cooperation

Presentation Overview

- Background
- Ongoing/Planned Activities
- Ukrainian Reliability Database (URDB)
- Russian Reliability Database (RRDB)
- Generic Component Reliability Database (GCRDB)
- International Reliability Database (IRDB)
- Summary

Background – Component Reliability Database (CRDB)

CRDBs collect component and system information from individual nuclear power plants (NPP) and share the information between the plants to provide input to:

- Probabilistic safety analysis (PSA)
- Reliability centered maintenance (RCM)
- Component predictive maintenance
- Component performance monitoring
- Component failure trending
- Repetitive failure analysis
- Common mode failure analysis
- System performance monitoring
- System failure trending
- Operating experience review

Background – CRDB Goals

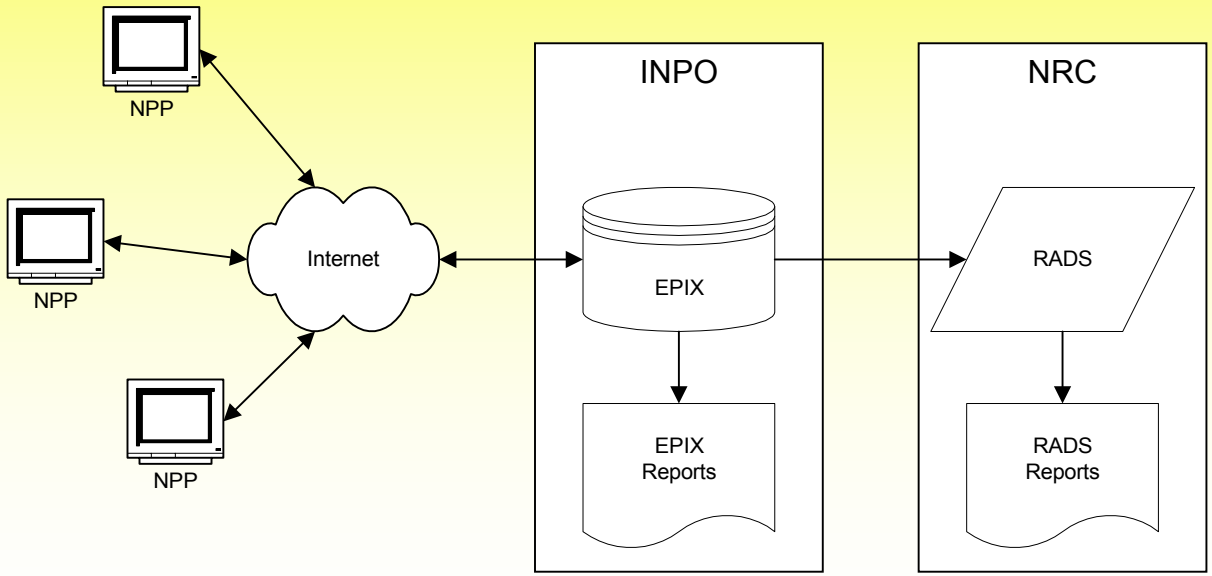
- To provide plants with an efficient tool for prioritizing the equipment problems to be solved, based on their relative contribution to safety and power generation
- To help plants recognize emerging patterns of equipment failures that may be obscured because they occur in widely separated pieces of equipment
- To provide plants with an industry knowledge-base of known solutions to equipment problems or to peers with the same problem, so that the burden of developing a common solution can be shared.

Background - CRDB in the US

- After Three Mile Island – Institute of Nuclear Power Operations (INPO) Took Ownership of Nuclear Plant Reliability Data System (NPRDS)
- NPRDS was maintained on a main frame computer with modem access for input and output from/to plants.
- NPRDS did not collect adequate information to support PRA, RCM, or other reliability based analysis.
- INPO recently created the Equipment Performance and Information Exchange (EPIX) to replace NPRDS.

Background - EPIX Details

- Originally a MS Access Database at each plant and information was sent to INPO via mail, modem, or Internet (Version 3 and earlier).
- Newest version (Version 4) is entirely Internet based. Database maintained at INPO. Information now shared with NRC in addition to between NPPs



Background – PRA Databases

- Relational data structure that supports the dissemination, distribution, and sharing of acceptable PRA basic event values (from Western, European, and Soviet-designed reactor studies), as well as the archiving of the rational and methods behind the development of any specific value.
- This same structure can be used to archive and share information from any unit's specific values.
- Referred to as PRADB or Generic Component Reliability Database (GCRDB)

Ongoing/Planned Activities

Component Reliability Databases (CRDB)

Build Centralized Structure

Build Centralized Applications

Develop Standard Definitions

Migrate Host-country Archived Info

Build Localized Structure

Build Localized Applications

Implement Pilot Plant

Customize Localized Applications

Implement at all NPPs

Plants Share Info via Centralized Master

Share Info with International Partners

Build Analysis Applications

Analyze Historical Data

Analyze New Data as it is Entered

PRA Databases (PRADB)

Generic PRA Database (GCRDB)

Perform Other Analysis

Build GCRDB Structure

Populate With IAEA Data

Populate With Plant Data

Populate With Analyzed Historical Data

Populate With Other Analysis Data

Continue to Add and Share Data

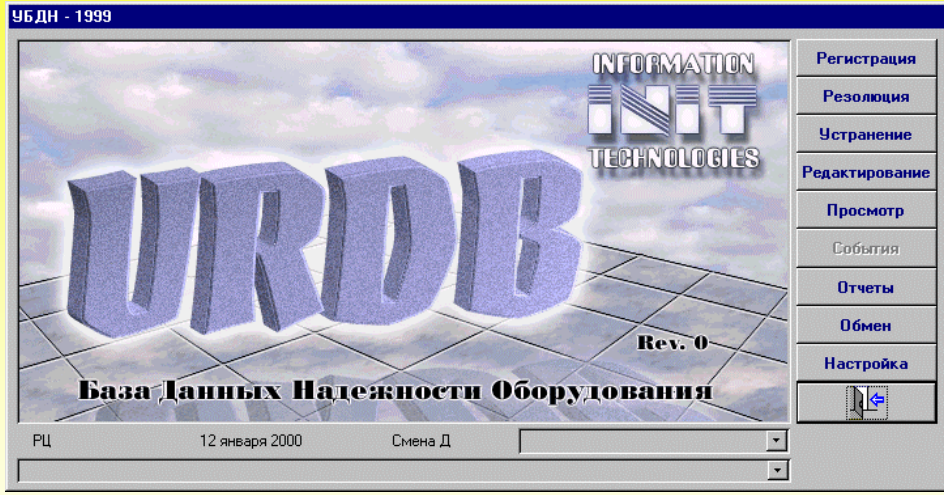
Plant PRA Database (Each plant develops its own for its PRA - Outside scope of Project activities)

Calculate Plant Specific Data for PRA

Archive PRA Data in a Database

Continue to Add, Share, and Re-evaluate Data

Ukrainian and Russian CRDBs



Ukrainian Reliability Database (URDB) Additional Apps.

п.	Name of application	Purpose of integration with the URDB	Department-User at KhNPP
1.	Module of the development of valve repair reports.	a) Input of the data about valve repair into URDB for reliability analysis tasks. b) Specification of valves data in the URDB (list of valves, types, manufacturers).	Centralized maintenance and repair department
2.	Module of the account of rotating mechanisms service life time (exposure)	a) Input of the rotating mechanism exposure data into URDB. b) Synchronization of the rotating mechanisms data with URDB (list of mechanisms, types, manufacturers).	Reactor department, Turbine department, Department of cooling and conditioning
3.	Module of the development of equipment repair schedule and report.	a) Adding of the data about periodicity, types, and dates of the valves repair to the URDB. b) Adding of the data about manufacturer type and dates of beginning of the valves operation to the URDB.	Production technical department
4.	Module of the registration of equipment testing	a) Input of the data about periodicity and dates of testing into URDB. b) Synchronization of the equipment data with URDB.	Reactor department
5.	Module of the on-line registration of I&C equipment defects.	a) Input of the data about I&C equipment defects of the normal operation systems, similar to the defects of equipment of safety systems and important for safety systems. b) Adding of the URDB with I&C equipment data (list, manufacture types, manufacture numbers).	I&C department

Generic Component Reliability Database (GCRDB)

Microsoft Access - [multilanguage : Form]

File Edit View Insert Format Records Tools Window Help

US RU CZ

MC	Механические элементы	интенсивность отказов	
V	клапаны, задвижки	в час	
VX	Задвижка, ручная		
Y	Протечка/внешняя течь		

NPP - name and block number		country	точечная оценка	1.50E-06	среднее
reactor type	MWe	model	нижняя граница	1.30E-06	5%
system			верхняя граница	2.10E-06	95%

IAEA-TECDOC-478

International Atomic Energy Agency. 1988. Component Reliability Data for Use in Probabilistic Safety Assessment. IAEA-TECDOC-478.

распределение	лог-нормальное
параметр 1	1.2
параметр 2	0

станционные данные

ИСТОЧНИК: Данные по реакторам на тяжелой воде
ПЕРВОИСТОЧНИК: Опыт эксплуатации реакторов на тяжелой воде
ЭКСПЛ. УСЛОВИЯ: нормальные
ЭКСПЛ. РЕЖИМ: все
КОММЕНТАРИИ: детали неизвестны
КОММЕНТАРИИ 1-3: размер выборки - 1179. Общее время эксплуатации компонентов - 84.2 часа. Кол-во отказов - 122.

отказы	122
наработка	84200000

Record: 1000 of 1010

Form View NUM

International Reliability Database (IRDB)

- Both the URDB and RRDB are being built with ability to export EPIX compatible data.
- WANO reached agreement with INPO to allow its use of the EPIX Version 3 structure and tools. Discussions are in progress concerning EPIX Version 4.
- Meetings were held with WANO in October 1999 at which time participants from most countries with Soviet-designed reactors agreed in principle to share information via an IRDB.
- Progress on hold pending further development of URDB and RRDB and resolution of other issues.

Summary

- **Status:**
  - **CRDB development in Ukraine and Russia is in progress with full implementation available for plants expected in next two years.**
  - **Analysis Tools for CRDBs are under development.**
  - **GCRDB initial structure and population with IAEA is complete.**
- **Activities in Next Year**
  - **Further expand pilot CRDB implementations in Ukraine and Russia.**
  - **Enhance GCRDB reporting tools. Populate GCRDB with data from contributing plants and from an industry study. Distribute between plants who have contributed or who have agreed to contribute.**